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An Evaluation of the Effects of a Diabetes Self-Management Education Program on the HbA1c in Patients with Type 2 Diabetes

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The document mentioned above has been reviewed and accepted by the student's advisor, on behalf of the advisory committee, and by the Assistant Dean for MSN and DNP Studies, on behalf of the program; we verify that this is the final, approved version of the student's DNP Project including all changes required by the advisory committee. The undersigned agree to abide by the statements above.

Katherine Schoo, Student

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An Evaluation of the Effects of a Diabetes Self-Management Education Program on the HbA1c in Patients with Type 2 Diabetes

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University of Kentucky

Spring 2018

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Dedication

I would like to dedicate my final practice inquiry project to my family and friends who have supported me throughout my doctoral education.

I could not have done this without you.

Acknowledgements

I would like to acknowledge Dr. Sharon Lock, who has served as my student advisor, and committee chair since day one in my doctoral studies at the University of Kentucky. Her direction and reassurance throughout this five-year journey has been critical to my success as a student. I would like to thank Dr. Lynne Jensen for being my committee member and helping me throughout this process. I would also like to thank Dr. Laura Hieronymus for serving as my clinical mentor and sharing the same passion I have for the continued efforts towards diabetes education and prevention. Lastly, I would like to thank Amanda Wiggins for her assistance with the statistical analysis of my project data.

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Practice Inquiry Project Introduction

Katherine Schoo

University of Kentucky

Introduction

Type 2 diabetes mellitus has become a global epidemic with a rapidly growing prevalence across the world. According to the Centers for Disease Control and Prevention (CDC), more than 30.3 million Americans are living with diabetes. Type 2 diabetes accounts for 90-95% of all diagnosed cases, making both the health, and economic costs for this disease enormous (Centers for Disease Control and Prevention [CDC], 2018).

Developments in diabetes care and management have greatly evolved over the last several decades. Diabetes care has shifted from a treatment-oriented plan of care, to a proactive, prevention-based plan of care. The American Diabetes Association sets forth standards of medical care in diabetes each year. The most recent guidelines emphasize a comprehensive treatment plan with individualized diabetes education for each patient. The education should include healthy lifestyle choices, a diet plan, exercise plan, medication regimen, and behavioral modification (American Diabetes Association, 2018). The "Active Steps for Diabetes" program is an example of a diabetes self-management education program that caters diabetes education and care management to an individual based on their personal needs. It has shown in most cases, to effectively reduce hemoglobin A1c (HbA1c) levels in patients with type 2 diabetes over the course of the 3-month program.

This practice inquiry project has been completed in accordance with guidelines set forth by the University of Kentucky's Doctorate of Nursing Practice program, and is a collection of three manuscripts which discuss type 2 diabetes management and education. The first manuscript is a Health Problems Paper which addresses the Healthy People

2020 objectives for diabetes through nursing care, theory, and evidenced-based guidelines. The second manuscript is a systematic literature review of several research articles highlighting the implementation of diabetes self-management education programs into the health care of individuals with type 2 diabetes. The third, and final manuscript details a Practice Inquiry Project, which evaluated a diabetes self-management education program called “Active Steps for Diabetes” for its ability to decrease the HbA1c levels in patients with type 2 diabetes.

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Manuscript I: Diabetes: The Epidemic of a Nation

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Abstract

According to the American Diabetes Association (2018), diabetes was labeled the 7th leading cause of death in the United States in 2015 and was estimated to cost roughly $327 billion dollars for direct medical costs, and reduced productivity. With an increasing prevalence in the diagnosis of type 2 diabetes yearly, the United States Department of Health and Human Services listed diabetes prevention and education as one of the Healthy People 2020 leading health indicators (Health People 2020, 2016).

Bandura's Social Cognitive Theory can be used to help transform specific knowledge into beneficial health practices, thereby shedding light on people's capacity for modification of their lifestyle to better serve their overall wellbeing and health outcomes (Bandura, 2004). This theory, used in conjunction with evidence-based diabetes guidelines, can better aid in the development of successful diabetes self-management education programs targeting the goals of Healthy People 2020.

Introduction of the Health Problem and Purpose Statement

Individuals suffering from diabetes mellitus often have poor access to education and management for their disease. More so, these individuals are unaware of the risks for comorbidities relevant to their disease and how to self-manage their diabetes care. In 2015 approximately 30.3 million American children and adults had diabetes (American Diabetes Association [ADA], 2018). Of those 30.3 million people, about 23.1 million were already diagnosed with the disease, while the other 7.2 million people still remained undiagnosed (ADA, 2018). In the year 2015, 9.4% of the total American population had diabetes and it was labeled the 7th leading cause of death in the United States (ADA, 2018).

As these statistics continue to rise each year, and an estimated 84.1 million people have been diagnosed with prediabetes, the emphasis on diabetes care has shifted from treatment of the disease to educating patients on how to prevent complications and comorbidities related to diabetes, as well as education and self-management (ADA, 2018). With the prevalence of type 2 diabetes mellitus in those aged 18 years and older increasing, it is imperative as an advanced practice registered nurse in the primary healthcare setting to explore innovative and evidence-based ideas to educate patients about the risks and complications of the disease. For patients who have already been diagnosed with the disease, education about disease management, treatments, and creating a healthy lifestyle will become the primary focus. The purpose of this paper is to present the epidemiology of diabetes mellitus, discuss one of the leading health indicators established by Healthy People 2020 for people with diabetes, and to describe both a

theoretical framework for guidance, as well as a clinical practice guideline for managing the health problem.

Healthy People 2020 Objectives

One essential objective of the Healthy People 2020 leading health indicators is to improve glycemic control among people aged 18 and older with diabetes. The subtopic for this indicator aims to reduce the proportion of those with diabetes whose hemoglobin A1c (HbA1c) values are greater than 9% and to increase the proportion whose HbA1c values are less than 7% (Healthy People 2020, 2016). By reducing the proportion of patients whose HbA1c values are above 9% and increasing the proportion of those with an HbA1c value less than 7%, the prevalence of diabetes related comorbidities and mortalities can be greatly reduced.

Between the years 2005 and 2008, 17.9% of adults aged 18 years and older with diabetes reported having a HbA1c value of 9% or greater, and 53.5% of adults aged 18 years and older with diabetes reported having a HbA1c value of 7% or less (Healthy People 2020, 2016). With these reported baselines the government established new goals for these objectives in Healthy People 2020. The Healthy People 2020 goals were to be set at 16.1% for those with a HbA1c value of greater than 9% (a 1.8% overall decrease and improvement in HbA1c values among adults with diabetes aged 18 years and older), and an increase of 5.4% of those with a HbA1c value of less than 7% to an overall target rate of 58.9% (Healthy People 2020, 2016).

Another objective of the Healthy People 2020 leading health indicator is to increase the proportion of those diagnosed with diabetes who receive formal diabetes education (Healthy People 2020, 2016). Diabetes education has proven effective in

improving clinical outcomes, support informed decision-making, self-care behaviors, overall health status, and moreover, the quality of life for those diagnosed with diabetes (Funnell et al., 2011; Renders et al., 2001).

According to Healthy People 2020 (2016), in 2008 56.8% of adults aged 18 years and older with diabetes reported receiving formal diabetes education. Their target percent for the year 2020 is to establish formal diabetes education to at least 62.5% of adults aged 18 years and older with diabetes (Healthy People 2020, 2016). Diabetes education plays a significant role in establishing groundwork for the lifestyle changes required to effectively manage the disease and improve outcomes such as the HbA1c value. Therefore, it is critical for adults to undergo formal diabetes education and self-management training in order to maintain accurate blood glucose levels and sustain their HbA1c value at less than 7% (Diabetes Prevention and Control, 2001; Funnell et al., 2011).

Theoretical Framework

Albert Bandura's Social Cognitive Theory illustrates a set of determinants, the system in which they function, and the most effective ways to transform specific knowledge into beneficial health practices (Bandura, 2004). This theory suggests that human behaviors are heavily affected by an interaction between personal, behavioral, and environmental pressures, but focuses on people's capacity to modify and regulate their environment to better serve their wellbeing (McAlister, Perry, & Parcel, 2008). This framework can be used to describe and strengthen the explanation for diabetes self-management education to promote the need for both frequent daily glycemic monitoring, as well as HbA1c values for patients with diabetes.

Bandura's theory focuses on the ability of each individual to change or modify their behaviors based on their own personal capacity for change, as well as how much assistance from others they will need in order to do so (McAlister, Perry, & Parcel, 2008). The structure of this theory offers a threefold stepwise implementation model and calls for specific terms for each rung. Each level of this approach is customized and modified to a person's self-management potential and motivational capability to achieve their desired change and suggest how to enable people at each level to improve their lifestyle habits and overall health (Bandura, 2004).

- First-Level:
    - High level of self-efficacy
    - Confidence in their ability to change
    - Belief they are in charge of the changes in their lives
    - Perception of a goal and the ability to easily obtain the resources and tools they need in order to reach that goal

      (McAlister, Perry, & Parcel, 2008)
    - Positive outcome expectations for the behavior change they are trying to adapt
    - Require very minimal guidance in order to accomplish the changes they seek

      (Bandura, 2004)
- Second-Level:
    - Slightly lower level of self-efficacy
    - Feeble and halfhearted efforts to make a change

    - Quickly renounce any efforts that do not give them immediate positive outcomes or that come with any difficulty
    - These people need added guidance and support in order to meet and accomplish the goals they have set forth for themselves
- Third-Level:
    - Believe in an external locus of control
    - Believe their health habits are out of their personal control and they cannot make the changes necessary for a healthier life
    - Need the most guidance and benefit the most from a structured program setting
    - Their confidence is built only by the progressive successes in tasks they attempt to perform, and they are eventually able to bolster some staying power regardless of the difficulties and setbacks that come about throughout the process

(Bandura, 2004)

This framework helps assess an individual's ability to learn self-management techniques and establish a healthy lifestyle with diabetes congruent with maintaining a HbA1c value below 7%. It allows providers the ability to establish their patient's willingness to take control of their disease and actively partake in the changes that are necessary for an improvement in glycemic control. Once glycemic control is sustained with a HbA1c value less than 7%, greater health consequences and comorbidities, as well as mortality rates are significantly reduced. As the quality of life and overall health status of the individual increases, so does their confidence in their ability to control their health

and wellbeing. Patients may observe their HbA1c value begin above 7% when first diagnosed with diabetes, however as they are educated on the nutritional benefits of a healthy diet, engage in regular exercise, and institute a medication regimen with their provider, they may see their HbA1c value decrease over time. Slow and steady progress towards an optimal HbA1c level benefits the patient's health outcomes, and patients gain more confidence in their ability to control and manage their healthier diabetes lifestyle. This new-found confidence and control over their life and disease, improves their self-efficacy even further. (Bandura, 2004).

Screening Tools

Multiple screening tools exist for the diagnosis and screening of diabetes. The American Diabetes Association recommends screening asymptomatic individuals who are at an elevated risk for being diagnosed with diabetes at 3-year intervals using tests such as a fasting plasma glucose (FPG) test, a 2-hour oral glucose tolerance test (OGTT), or a glycosylated hemoglobin A1c (HbA1c) level. Testing these individuals before they become symptomatic would put them at lesser risk of developing complications from the disease, as well as minimize the long-term microvascular and macrovascular changes that occur with prolonged and untreated hyperglycemic events (ADA, 2018).

Studies have battled to answer the question of which test is the most appropriate in diagnosing prediabetes and type 2 diabetes, as well as screening for health maintenance once the disease has already been diagnosed. Each study is coming to the same conclusion about the reliability and relevance of each of the diagnostic and screening tools. Conversely, while the HbA1c test is more expensive, it does not require patients to fast and has shown less variability among individuals. Conclusions from these

studies consistently show similar findings - one test is not significantly more accurate than another in the diagnosis of the disease. (Mannarino, Tonelli, & Allan, 2013).

The American Diabetes Association however, recommends the use of a HbA1c level be drawn every 3-6 months as a screening tool for glycemic control in individuals who have already been diagnosed with diabetes depending on the stability of a patient's control. The HbA1c results show the cumulative effect of hyperglycemic episodes over the course of a 2-3-month period (the average lifespan of a red blood cell (RBC)) providing an analysis of the individual's average blood glucose (ADA, 2018). People with diabetes will have different HbA1c levels and target levels given to them by their providers based on their diabetes history and overall general health. However, studies have shown that the risk for complications from diabetes can be greatly reduced by maintaining an HbA1c level less than 7% ("The A1c Test and Diabetes", 2014). Reduction of the HbA1c level is possible with the implementation of an overall healthier lifestyle, and in some cases medication management. In addition to medication prescribed by a provider, a health-conscious diet, as well as routine daily exercise can decrease the HbA1c levels in a patient with diabetes. Therefore, by working towards the Health People 2020 goal of a greater percentage of adults with diabetes decreasing their HbA1c values below 7%, there will be in turn a decreased risk for complications among those patients.

In 2009, the International Expert Committee for the American Diabetes Association recommended the HbA1c test as one of the diagnostic tools for both type 2 diabetes and prediabetes. Since this test does not require fasting and can be drawn at any time of the day regardless of certain parameters and conditions that are needed for other

tests, the experts believed its convenience would allow for more people to get tested. This in turn would lead to fewer people with undiagnosed diabetes, an increased number of people who were made aware of their risk for prediabetes, and better guidelines and progress reports for those already diagnosed with the disease (The International Expert Committee, 2009).

Guidelines

The American Diabetes Association in accordance with reviews from expert panels, the Executive Committee of the Board of Directors, as well as the Professional Practice Committee of the American Diabetes Association establishes guidelines and recommendations intended to aid patients, researchers, clinicians, and other individuals involved in diabetes care with the tools to evaluate the quality of care for people with diabetes. This committee is comprised of a multidisciplinary team including physicians, nurse practitioners, registered nurses, diabetic educators, registered dietitians, and many others who have expertise in the areas of endocrinology, epidemiology, hypertension, nephrology, lipids, and other clinical research involving diabetes (ADA, 2018). The guidelines made by the American Diabetes Association and these professional committees include diagnostic, screening, and therapeutic recommendations that have been thoroughly researched and weigh heavily on the advances in healthcare to improve health outcomes in people with diabetes.

This specific set of guidelines put forth by the American Diabetes Association are called the "Standards of Medical Care in Diabetes" (ADA, 2018). While these recommendations are not intended to exclude clinical judgement, they are intended to be

applied within the individual's clinical context in order to aid in the medical and self-management care of the disease.

One of the American Diabetes Association's clinical guidelines from the "Standards of Medical Care in Diabetes" is the suggestion of lowering HbA1c values to 7% or less. They issued this recommendation with A-level evidence (evidence directly based on the meta-analysis of randomized controlled trials) because an HbA1c value of less than 7% has been associated with maintaining a reduction in microvascular complications of diabetes, as well as with long-term reduction in macrovascular disease. Therefore, the American Diabetes Association recommends the maintenance of an HbA1c value below a 7% for individuals with diabetes in order to reduce the comorbidities caused by these complications (ADA, 2018).

As defined by the task force which sets the national standards for diabetes self-management education and support, diabetes self-management education is:

> The ongoing process of facilitating the knowledge, skill, and ability necessary for prediabetes and diabetes self-care. This process incorporates the needs, goals, and life experiences of the person with diabetes or prediabetes and is guided by evidence-based standards. The overall objectives of diabetes self-management education are to support informed decision making, self-care behaviors, problem solving, and active collaboration with the health care team and to improve clinical outcomes, health status, and quality of life (Haas et al., 2012, p. 2394).

Due to the magnitude of the impact self-management and education play in the ability of a person to care for themselves or someone they know with diabetes, a task force convened by the American Diabetes Association Educators and the American Diabetes

Association established guidelines specific to diabetes self-management education in the summer of 2006, which were later approved for practice in March of 2007 (Funnell et al., 2011). Since then, this task force has reviewed and revised these standard and guidelines in order to keep up to date with the latest clinical and evidence-based research available.

Prevention and behavior change strategies to lower an individual's HbA1c value cited by the American Diabetes Association and their task force follow the basic lifestyle changes and modifications that are required for a person with diabetes to sustain an average blood glucose level between 80-130 mg/dL (ADA, 2018). For each type of diabetes (type 1, type 2, prediabetes, and gestational diabetes), and each patient, there are adjustments that need to be made by the provider in order to individualize the care and lifestyle modifications that will best suit that person's needs. However, each plan of care for diabetes includes the same important aspects of self-management - glucose monitoring, dietary recommendations, exercise, medication self-administration, and follow-up appointments with a multidisciplinary team of healthcare providers (ADA, 2018; Funnell et al., 2011; Renders et al., 2001).

Conclusion

In conclusion, the prevalence of diabetes and prediabetes are continuously rising, with more and more people being diagnosed every year. Healthy People 2020 has made it a significant objective in their list of leading health indicators and has set forth goals and recommendations on how to improve the health outcomes of those diagnosed with the disease, as well as how to prevent people at an elevated risk from developing the disease (Health People 2020, 2016). Continuous efforts to improve self-management education and support will aid in the development of long-term behavior modification

programs. With task forces and committees made up of multidisciplinary teams all working towards the same goal, it is inherent that progress will be made in the struggle against this disease.

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Manuscript II A Systematic Literature Review of Diabetes Self-Management Education Programs

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Abstract

Experts estimate that approximately 382 million people worldwide were diagnosed with diabetes in the year 2013. It is estimated that by the year 2035 this number will increase to an astounding 592 million people worldwide - 80% of which live in low to middle-income countries (International Diabetes Federation, 2013). Type 2 diabetes is associated with multiple medical complications, as well as health-related comorbidities that contribute to an earlier mortality. There has been a vast increase in research performed on the best lifestyle changes and treatment options available to individuals diagnosed with this disease. With this extensive research, there is growing evidence showing the effectiveness of interdisciplinary disease-management programs that incorporate self-management and educational principles improving a patient's long-term diabetes health outcomes. This literature review highlights eight research articles in which studies were performed to evaluate diabetes self-management education programs into the health care of individuals with type 2 diabetes.

Reference

International Diabetes Federation. (2013). IDF Diabetes Atlas (6th ed.), Brussels, Belgium, http://www.idf.org/diabetesatlas

Introduction

When the body does not make enough insulin, or when the insulin cannot be used effectively, blood glucose builds up in the blood. This high blood glucose can lead to comorbidities such as blindness, heart disease, stroke, kidney failure, macrovascular, and microvascular diseases leading to amputations. Diabetes mellitus has become a leading health concern in the United States and effects more than 30.3 million Americans. This number accounts for 9.4% of the total American population and continues to rise each year (American Diabetes Association [ADA], 2018).

Hemoglobin A1c (HbA1c) is a measure of diabetes control over a 2-3-month period (the approximate lifespan of a red blood cell). According to the clinical practice recommendations made by the American Diabetes Association in 2018 the maintenance of a HbA1c <7% in an adult with type 2 diabetes can help reduce both macrovascular and microvascular complications of the disease (ADA, 2018). Epidemiological studies have revealed that a 1% reduction in HbA1c can lead to a 15%–21% reduction in diabetes-related deaths and a 33%–41% reduction in microvascular complications over a 10-year period (Stratton, Adler, & Neil, 2000). A HbA1c level greater than 7% has been identified as a significant risk factor for cardiovascular diseases, however by improving glycemic control in patients with type 2 diabetes, the risk for microvascular and macrovascular complications is greatly reduced (Sherwani, Khan, Ekhzaimy, Masood, & Sakharkar, 2016). The purpose of this paper is to review the effects of diabetes self-management education programs on blood glucose control (HbA1c) among individuals with type 2 diabetes.

Methods

A review of the PubMed database was performed using the following keyword combinations: Type 2 diabetes mellitus AND self-management programs AND A1C OR blood glucose control, Type 2 diabetes mellitus AND self-efficacy programs AND A1C OR blood glucose control, Type 2 diabetes mellitus AND disease-management programs AND A1c OR blood glucose control, non-insulin dependent diabetes AND self-management AND A1c OR blood glucose control, non-insulin dependent diabetes AND self-efficacy programs AND A1C OR blood glucose control, and non-insulin dependent diabetes AND disease-management programs AND A1C OR blood glucose control. References made within the studies were also included to the key word search in order to potentially narrow the search to more relevant articles. The search was limited to English language articles with no publishing time limitation. The studies had to be among individuals with type 2 diabetes mellitus. Included studies were conducted in the U.S. and international countries. Studies performed on animals, literature reviews, and meta-analyses were excluded from this review. The total number of studies retrieved from PubMed was 1,459 studies. After assessing titles and abstracts of the 1,459 studies eight were selected for this review. These eight studies were selected based on their inclusion and exclusion criteria, and their similar program objectives. Table 1 displays the purpose, methods, and results of each study.

	Study #1	Study #2	Study #3	Study #4	Study #5	Study #6	Study #7	Study #8
Complete citation:	Rasekaba, T., Graco, M., Risteski, C., Jasper, A., Berlowitz, D. J., Hawthorne, G., & Hutchinson, A. (2012). Impact of a Diabetes Disease Management Program on Diabetes Control and Patient Quality of Life. *Population Health Management, 15*(1), 12-19. doi:10.1089/pop.201	Welch, G., Allen, N.A., Zagarins, S.E., Stamp, K.D., Bursell, S., & Kedziora, R.J. (2011). Comprehensive Diabetes Management Program for Poorly Controlled Hispanic Type 2 Patients at a Community Health Center. *The Diabetes Educator, 37*(5), 680-688. Doi: 10.1177/0145721711416257	Mash, B., Levitt, N., Steyn, K., Zwarenstein, M., & Rollnick, S. (2012). Effectiveness of a group diabetes education programme in underserved communities in South Africa: pragmatic cluster randomized control trial. *BMC Family Practice,* 13:126. doi:10.1186/1471-2296-13-126	Hill-Briggs, F., Lazo, M., Peyrot, M., Doswell, A., Chang, Y., Hill, M.N., Levine, D., Wang, N., & Brancati, F.L. (2011). Effect of Problem-Solving-Based Diabetes Self-Management Training on Diabetes Control in a Low-Income Patient Sample. *Journal of General Internal Medicine, 26*(9), 927-978. DOI: 10.1007/s11606-011-	Silva, M., Clinton, J., Appleton, S., & Flanagan, P. (2011). Diabetes Self-Management Education in South Auckland, New Zealand, 2007-2008. *Preventing Chronic Disease: Public Health, Research, Practice, and Policy, 8*(2), 1-8.	Chai, S., Yao, B., Xu, L., Wang, D., Sun, J., Yuan, N., & Zhang, X. (2018). The effect of diabetes self-management education on psychological status and blood glucose in newly diagnosed patients with diabetes type 2. *Patient Education and Counseling*. https://doi.org/ezproxy.uky.edu/10.1016/j.pec.2018.03.020	Adam, L., O'Connor, C., & Garcia, A. (2017). Evaluating the impact of diabetes self management education methods on knowledge, attitudes, and behaviors of adult patients with type 2 diabetes mellitus. *Canadian Journal of Diabetes*. https://doi.org/10.1016/j.jcjd.2017.11.003	Yuan, C., Lai, C., Chan, L., Chow, M., Law, H., & Ying, M. (2014). The effects of diabetes self-management education on body weight, glycemic control, and other metabolic markers in patients with type 2 diabetes mellitus. *Journal of Diabetes Research*. https://doi.org/10.1155/2014/789761

	1.0002			1689-6				
Research purpose, question, or hypothesis:	Assess the impact of a disease-management program (NA-HARP) on patient's glycemic control	Evaluate the clinical usefulness of the Comprehensive Diabetes Management Program (CDMP) on key diabetes outcomes	To evaluate the effectiveness of the group diabetes education program	To pilot test feasibility, acceptability, and effect on disease control of a problem-based diabetes self-management training adapted for low income and accessibility patients	Evaluate a diabetes self-management education program implementation	Evaluate the efficacy of self-management education on psychological outcomes and glycemic control in type 2 diabetes mellitus	Compare effectiveness of 2 DSME methods by examining changes in HbA1c and knowledge, attitudes, and behavior after traditional group education or diabetes conversation maps	Evaluate the effect of DSME on metabolic markers in patients with type 2 diabetes
Study design:	Evaluation and Data Analysis	Randomized controlled trial	Pragmatic randomized controlled trial	2-arm randomized controlled trial	Questionnaire	Randomized controlled trial	Randomized controlled trial	Randomized controlled trial
Independent Variables and Dependent Variables:	IV: Glycemic control (measured by A1c) DV: implementation of a multidisci	IV: diabetes health outcomes (HbA1c, BP, BMI, etc.) DV: Enrollment	IV: diabetes self-care activities, weight loss, HbA1c, self-efficacy, locus of control, BP, QOL, etc.	IV: HbA1c, BP, LDL, HDL, behavioral knowledge, problem-solving, and self-management behavior	IV: HbA1c, BMI, and BP DV: participation in 3-month long DSME program	IV: HbA1c, anxiety score, depression score, fasting blood glucose, and postprandial blood sugar	IV: HbA1c, changes in knowledge, and changes in attitude DV: participation in 3-month long	IV: HbA1c, carotid intima-media thickness (CIMT), and carotid arterial stiffness (CAS)

	plinary disease-management program that incorporates self-management principles	in CDMP	DV: 4 sessions of group diabetes education	DV: group, problem-based diabetes self-management training program		DV: participation in a 6-month long DSME program	education	DV: 3-month education intervention (8 weeks of education and 4 weeks of practicing education)
Sample and Setting:	Sample: 545 people, mean age 60 years, 53% male Setting: outpatient	Intervention: n=25, mean age 54.4 years, 68% female Control: n=21, mean age 57.5 years, 61.9% female Outpatient	40 patients per health center, 720 patients in the intervention group, 850 in the control group, TSDM	56 urban AA patients with T2DM and suboptimal BS, BP, and cholesterol control	n=193, ages 21-87 years with mean age 57.6 years, 2/3 women	n=118, education group n=63, control group n=55, inpatients and outpatients	n=21, education through DSME conversation maps n=10, traditional education n=11	n=76, intervention group n=36, and control group n=40
Methods and Measures:	Diabetes model of care (interdisciplinary assessment, apt. with endocrinologist, apt. with diabetes	Demographic data by medical chart, A1c, BP, frequency of diabetic foot screening, ASA use for cardiovascular risk	Medical records, questionnaires	HbA1c, BP, LDL and HDL, behavioral knowledge, and self-management behavior	Questionnaires: 1) health attitude 2) health behavior and clinical measures of HbA1c, BP, and BMI	Education group: 2-hour DSME program every week for 6 months, diet, exercise, self-monitoring	Questionnaires and repeated-measure pre-test and post-test design before and after education sessions,	HbA1c, blood pressure, weight, CIMT, and CAAS Intervention group: 3-month intervention

	nurse educator), minimum of 3 sessions with program – up to 12 months. Change in HbA1c and improvement in HR-QOL measured by change in assessment of quality of life (AQOL) at 12 months post enrollment of at discharge from the program	reduction by questionnaire, self-report eye exam data				of blood glucose, diabetes education, anxiety and depression scales Control group: no diabetes education provided by DSME program, 5-10 mins of outpatient diabetes education during routine outpatient visits	HbA1c before and after 3-month class	Control group: standard advice on medical nutrition therapy
Reliability and Validity:	HR-QOL (AQOL)	"20-item Problem	Questionnaires	PMH, 14-item scale	Questionnaires and	SPSS version 16,	Questionnaires, SPSS	SPSS version 20

		Areas in Diabetes" scale, "Diabetes Treatment Satisfaction Questionnaire-Change" (DTSQ-C), and PHQ-9 questionnaire for depression screening		on diabetes self-management, Health Problem-Solving Scale (HPSS), and Summary of Diabetes Self-Care Activities Scale (SDSCA)	focus groups, SPSS version 15	anxiety and depression scales	version 16	
Statistical/Data Analysis:	t-tests; descriptive statistics	t-tests; descriptive statistics	Survey/questionnaire	Frequency distributions, descriptive statistics	t-tests; descriptive statistics	Independent t-tests; paired t-tests; and Mann-Whitney U tests	t-tests; descriptive statistics	t-tests; Mann-Whitney U test; paired t-test; Wilcoxon Signed Ranks
Key Findings:	Statistically significant improvement in HbA1c at 12 months (8.6% versus 7.3%) Overall 68% of patients	Intervention group HbA1c decreased from 9.0% to 7.4% in 12-month period and control groups from 8.5% to 7.9%, diabetes	Further research needs to be done in order to better fit these types of education programs to better suit the population that is	HPSS at 3 months showed significant change in HbA1c,	Significant changes in participant health attitudes, behavioral changes, and small but significantly significant changes in reduction of	Significant reduction in depression, anxiety, and HbA1c (6.7% to 6.2%) between the education group and control group in a 6-month	Significant differences in knowledge and attitude scores after 3-month education sessions. Significant decreases in HbA1c levels from	Significant decrease in HbA1c level after 3-month intervention (mean reduction of 0.2%)

	experienced improvement in HbA1c	distress decreased in intervention group and increased in control group, no change in depression for either group	resource constrained and pressurized.		HbA1c	period	baseline to 3-months post education session	
Limitations:	Use of administrative data for evaluation	Small sample size and no use of professional diabetes educators	Not generalizable	Sample size, short follow up period	Language barriers, sample size, generalizability	Differences between Western and Eastern culture, food, etc. No subgroup analysis of whether blood glucose levels were related to the severity of anxiety and depression	Sample size, no follow-up period	Time interval was short, small sample size
Results/ Implications:	Multidisciplinary disease-management programs	CDMP intervention was effective in helping patients	Although group diabetes programs have been shown to be	The development of a problem-based, self-managemen	Self-Management education programs can work in multiethnic	Anxiety and depression can affect blood glucose levels.	Changes observed lead to improved diabetes self-	DSME, even in low intensity, can significantly improve

	have positive impact on glycemic control and HR-QOL over 12-month period	meet evidence-based guidelines for diabetes care	effective in resource rich countries, underdeveloped countries with little access to primary care show less effectiveness with program results	t training program for low literacy and income patients is feasible and helpful. Effective for an improvement in HbA1c was shown	high-needs communities with the right resources and accessibility	DSME programs help psychological factors related to diabetes and in turn improve glycemic control	management and help reduce costly health complications related to poorly controlled diabetes	glycemic control in patients with type 2 diabetes

Results & Synthesis

The included studies were conducted primarily in outpatient setting and represent data from a total of 2,604 patients. Study designs included an evaluation (Rasekaba, et al., 2012), six randomized controlled trial (Adam et al., 2017; Chai et al., in press; Hill-Briggs et al.,2011; Mash et al., 2012; Welch et al., 2011 & Yuan et al., 2014), and a quasi-experimental pre-post study (Silva et al., 2011). All studies examined the effects of a diabetes education program on diabetes health outcomes, specifically measuring HbA1c, while 75% included additional diabetes health clinical measures such as blood pressure or weight in their studies (Adam et al., 2017; Chai et al., in press; Hill-Briggs et al., 2011; Mash et al., 2014; Silva et al., 2011; Welch et al., 2011). In addition, 63% of the studies examined the effects of self-management behavior and self-efficacy on overall diabetes health (Adam et al., 2017; Chai et al., 2018; Hill-Briggs et al., 2011; Mash et al., 2012 & Yuan et al., 2014).

In Rasekaba et al.'s (2012) evaluation study, a diabetes program included an interdisciplinary assessment of overall health, an appointment with an endocrinologist, an appointment with a diabetes educator, and a minimum of three sessions within the program up to a total of one year in order to monitor a change in HbA1c and an improvement in quality of life measured by the Health Related Quality of Life (HR-QOL) screening tool. This study used a HbA1c of 8.0% to describe very good to adequate control, 8.1%-9.0% to describe suboptimal control, and a HbA1c of >9.0% to describe poor glycemic control (Rasekaba et al., 2012).

In two studies (Mash et al., 2012 & Welch et al., 2011) demographic data, as well as medical records were used to assess pre and post-program health information. Welch

et al (2011) specifically defined aspects of the program that measured pre and post-program HbA1c levels, blood pressure, weight, frequency of diabetic foot screenings, aspirin use for cardiovascular risk reduction, and self-reported eye exams. Another program (Hill-Briggs et al., 2011) measured diabetes health outcomes such as HbA1c, systolic blood pressure, diastolic blood pressure, LDL and HDL, and behavioral (knowledge, problem solving, self-management behavior) data at baseline or pre-program, post-intervention, and three months post-intervention. The researchers used the 14-itemDiabetes and Cardiovascular Disease (CVD) knowledge test based on information important for diabetes self-management from the American Diabetes Association's clinical practice recommendations and guidelines (Hill-Briggs et al., 2011).

Chai et al. (in press) evaluated the efficacy of self-management education on psychological outcomes and glycemic control in patient with type 2 diabetes. This study showed that when compared with the control group, the education/intervention group had a significant decrease in their overall anxiety and depression score, as well as a significant decrease in their fasting blood glucose, postprandial blood glucose, and HbA1c level after a 6-month education session with a p value<0.01.The researchers concluded that an increased prevalence of depression and anxiety in patients with type 2 diabetes effects blood glucose levels. However, through self-management education, psychological factors affecting these patients can be improved, resulting in better blood glucose control.

Yuan et al. (2014) aimed to evaluate the effects of a short-term diabetes self-management education program on metabolic markers including the HbA1c in patients with type 2 diabetes. The researchers concluded there was a statistically significant

reduction in HbA1c (mean reduction of 0.2%) after receiving the self-management education. Lastly, Silva et al. (2011) evaluated self-management attitudes and behaviors based on a questionnaire before and after the implementation of the program. Clinical diabetes health outcomes such as HbA1c were also evaluated at the pre-program baseline and three months post-program completion and decreased an average of 0.4% (Silva et al., 2011).

Of the eight studies examining the effects of diabetes education programs 88% showed significant improvements in HbA1c from pre-program to post-program levels (Adam et al., 2017; Chai et al., in press; Hill-Briggs et al., 2011; Rasekaba et al., 2012; Silva et al., 2011; Welch et al., 2011; Yuan et al., 2014). Mash et al (2012) described the need for further research into diabetes education programs that better suit a specific population that may be resource constrained. Two studies (Silva et al., 2011 & Welch et al., 2011) specifically highlighted the intervention helping patients meet evidence-based guidelines for diabetes care, as well as improving their diabetes self-management.

Conclusions & Implications

These studies provided research on the evaluation of diabetes self-management education programs on patients' overall diabetes health, specifically evaluating for the improvement in HbA1c levels (Adam et al., 2017; Chai et al., in press; Hill-Briggs et al., 2011; Mash et al., 2012; Rasekaba et al., 2012; Silva et al., 2011; Welch el al., 2011; & Yuan et al., 2014). Four of the eight studies used a large sample size with a mean sample age of around 60 years of age with both male and female patients (Chai et al., 2018; Hill-Briggs et al., 2011; Rasekaba et al., 2012; Silva et al., 2011). Adam et al. (2017), Mash et al. (2011), Welch et al. (2011) and Yuan et al., (2014) used smaller sample sizes

ranging from 21 to 76 which could be considered a limitation of their studies. Other limitations included the use of administrative data for evaluation (Rasekaba, 2012) and the lack of generalizability for certain studies among broader populations (Mash et al., 2012; Silva et al., 2011). Welsh et al.'s (2011) study did not use professional diabetes educators\ to provide the patients with diabetes education and was therefore unable to discuss the benefits of having a professional interdisciplinary collaboration throughout the program.

The findings of the reviewed studies suggest that there is enough evidence to support the implementation of diabetes self-management education programs into clinical practice. As these studies show, specific diabetes clinical measures can be improved through the implementation of a diabetes education program that provides self-management techniques and resources to patients (Adam et al., 2017; Chai et al., in press; Hill-Briggs et al., 2011; Rasekaba et al., 2012; Silva et al., 2011; & Yuan et al., 2014). The findings of the studies provide suggested options and criteria under which self-management education programs could be implemented into the health care regimen for individuals diagnosed with type 2 diabetes.

Six studies found statistically significant improvements in HbA1c levels within a 3 to 6-month period after implementation of the program (Adam et al., 2017; Chai et al., in press; Hill-Brigg et al., 2011; Rasekaba et al., 2012; Welch et al., 2011; & Yuan et al., 2014). These data suggest that over the course of 3-12 months, individuals with type 2 diabetes could benefit from education on their disease and self-management techniques on how to care for themselves and manage their disease. Rasekaba et al.'s study (2012) shows the importance of maintenance appointments, and follow-up appointments with

endocrinologists and diabetes nurse educators. These follow-up appointments help patients to succeed in their disease-management and further improve their HbA1c. More research must be performed to better identify what helps these programs succeed, however the evidence from this literature review can provide insight into the evaluation of these types of programs in the future.

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Manuscript III: An Evaluation of the Effects of a Diabetes Self-Management Education Program on the HbA1c in Patients with Type 2 Diabetes

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Abstract

Introduction

Diabetes has become an epidemic in the United States. More than 30.3 29 million Americans are living with the disease, while an additional 84.1 million Americans are living with prediabetes (Centers for Disease Control and Prevention [CDC], 2018). Standards set forth by the American Diabetes Association (ADA) describe comprehensive and individualized self-management education and treatment as part of their guidelines for the management of diabetes (ADA, 2018). The "Active Steps for Diabetes" program is an example of a diabetes self-management education (DSME) program that supports national recommendations made by the ADA.

Methods

This study was a retrospective descriptive pre- and post-test design which evaluated the HbA1c levels in patients with type 2 diabetes before, and after completion of the "Active Steps for Diabetes" program at a community health center located in an urban setting in a Midwest city. The first objective of this project was to describe the demographics of the patients who participated in the "Active Steps for Diabetes" DSME program during the academic semesters between Fall semester 2013 and Spring semester 2016. The second objective was to examine pre- and post-program HbA1c levels among patients who participated in the "Active Steps for Diabetes" DSME program during the academic semesters between Fall semester 2013 and Spring semester 2016.

Results

Findings showed participants of the "Active Steps for Diabetes" program had a statistically significant average decrease in their total HbA1c level of about 0.68% after

completion of the 3-month DSME program ($p < .0001$). Age and gender were not associated with any changes in HbA1c levels between pre- and post-intervention, and therefore did not play a significant role in the success of any participant.

Conclusions

The "Active Steps for Diabetes" program is a successful example of a DSME program for patients with type 2 diabetes. This program is structured to implement the standards and guidelines set forth by the American Diabetes Association and has been tailored to fit the individual needs of each participant based on a comprehensive approach to diabetes management and education.

Introduction

According to the International Diabetes Federation (2013), diabetes is one of the most non-communicable diseases in the world, globally affecting an estimated 382 million people (8.3% of the world's population). This number has been projected to reach pandemic levels by the year 2035, with the incidence almost doubling to an astounding 592 million people worldwide (International Diabetes Foundation, 2013).

Diabetes mellitus is classified as a group of metabolic diseases characterized by elevated levels of glucose in the blood (American Diabetes Association [ADA], 2018). This hyperglycemia is caused by defects in insulin secretion, defects in insulin action, or both. Chronic hyperglycemia associated with diabetes results in the damage, dysfunction, and/or ultimate failure of various organs including, but not limited to, the nerves, kidneys, eyes, blood vessels, and heart (American Diabetes Association [ADA], 2015). DSME Programs have demonstrated a decrease in HbA1c levels in participants. The purpose of this project was to evaluate the effects of a DSME program on the HbA1c levels of patients in a community health center.

Background

Type 2 diabetes accounts for roughly 90-95% of those with diabetes in the United States (Centers for Disease Control and Prevention [CDC], 2018). Patients with Type 2 Diabetes have insulin resistance, and eventually need insulin to control their rising blood glucose levels. These individuals often go undiagnosed for long periods of time as their body gradually develops insulin resistance. However, this delay in diagnosis can lead to an even higher HbA1c level at the time of disease identification (American Diabetes Association [ADA], 2015).

Care for people with diabetes accounts for more than 1 in 5 healthcare dollars in the U.S. with more than half of that expenditure directly attributable to diabetes. People with diabetes incur an average medical expenditure of about $13,700 per year, of which about $7,900 is attributed to diabetes. These patients pay approximately 2.3 times more in expenditures than they would without diabetes (Yang, Dale, Halder et al., 2013). Diabetes imposes a substantial financial burden on society in the U.S. Higher medical costs, lost productivity, premature mortality, and other intangible costs such as quality of life and undiagnosed diabetes have become an immense source of economic strain (Yang, Dale, Beronjia et al., 2018).

The indirect costs of diabetes pose an additional threat to the economic healthcare burden. Reduced employment, premature mortality, and work day absenteeism contribute to the indirect costs attributed to diabetes. An estimated $89.9 billion is lost annually due to these indirect costs of diabetes. It is projected that if people with diabetes participated in the labor force at rates similar to that of their peers without diabetes, an additional 2 million adults aged 18-64 years would be in the workforce (Yang, Dale, Beronjia et al., 2018).

Ongoing research has shown diabetes to be a controllable disease with behavior modification and lifestyle changes such as diet, exercise, smoking cessation, and proper treatment and medication regimens, as well as early diagnosis, collaborative health care teams, and self-management education (Adam et al., 2017; Bate & Jerums, 2003; Chai et al., 2018; Yuan et al., 2014). Collaborative diabetes self-management education programs are key components to health promotion, improving health outcomes, reducing overall economic healthcare burden, and increasing the quality of life for people with diabetes.

Significant and growing evidence shows how the expansion of diabetes self-management education programs within the community can improve diabetes outcomes and help lessen the financial burden of the disease (Anderson & Christison-Lagay, 2008; Yang, Dall, Beronjia et al., 2018; & Yang, Dall, Halder et al., 2013).

Diabetes self-management education (DSME) programs can decrease the HbA1c level in patients with type 2 diabetes by as much as 1%, thereby reducing the development and progression of diabetes complications (Powers et al., 2015). Norris, Lau, Smith, Schmid, & Engelgau (2002), performed a meta-analysis on the effects of diabetes self-management education programs on glycemic control in patients with type 2 diabetes. The results of the study showed on average a reduction in HbA1c level by 0.76% at immediate follow-up compared to the control group. The results also showed further improvement in HbA1c levels when additional contact time was made between participants and educators; an average decrease in HbA1c levels of 1% for every 23.6 extra hours of interaction time (Norris et al., 2002).

Diabetes self-management education programs emphasize support for educated decision-making and self-care behaviors in collaboration with a health care team with the purpose of improving health and clinical outcomes, and overall quality of life in these individuals (Funnell et al., 2010). The "Standards of Medical Care in Diabetes" are a set of guidelines created by the Professional Practice Committee of the American Diabetes Association, established over time, and were most recently revised in 2018 to reflect the current evidence-based research and practice (ADA, 2018). These guidelines include recommendations for diabetes self-management education programs. These

recommendations were used in the implementation of the "Active Steps for Diabetes" DSME program (G. Pariser, personal communication, April 13, 2018).

Objectives

There were two main objectives for this study. The first objective was to describe the demographics of the patients who participated in the "Active Steps for Diabetes" DSME program at a community health center located in an urban setting in a Midwest city during the academic semesters between Fall semester 2013 and Spring semester 2016. The second objective was to examine pre- and post-program HbA1c levels among patients who participated in the "Active Steps for Diabetes" DSME program.

"Active Steps for Diabetes" DSME Program

The "Active Steps for Diabetes" DSME program is a collaborative partnership between a pre-bono community health center located in an urban setting and a small private university in the Midwest. Over an eight-year period, this inter-professional team has designed an evolving program that combines diabetes self-management techniques with participant-specific physical activity, nutrition, and medication management. The uniqueness of the program is the collaboration between nursing and physical therapy students supervised by a physical therapist and a nurse practitioner/certified diabetes educator. DSME "has been shown to be most effective when delivered by a multidisciplinary team…team members work interdependently, consult with one another, and have shared objectives" (Funnell, et. al., 2010, p. S90). The "Active Steps for Diabetes" program involves certified diabetes educators (CDEs), an advanced practice nurse, physical therapists (PT), a registered dietitian, and students from nursing, physical therapy, and lab sciences disciplines. The interdisciplinary framework used by the

"Active Steps for Diabetes" program promotes comprehensive care and offers a collaborative and integrated team approach.

The National Standards for DSME content areas establish an outline for developing a DSME curriculum. Content areas include disease process and treatment options, nutrition, physical activity, medication safety, glucose monitoring, preventing, detecting and treating acute and chronic complications, psychosocial concerns, health promotion and behavior change (Funnell et al., 2010). This content can be tailored or modified to match specific individual needs and is designed to represent topics that can be developed in basic, intermediate, and advanced levels. The "Active Steps for Diabetes" program addresses all of these content areas, both in education and in practice. The program involves an in-class physical activity component that is not typical among other DSME models. Participants are able to practice exercises in class and take home their skills to integrate into their daily lifestyles. The level at which individuals perform in-class exercises is established by their mobility restrictions in conjunction with a physical therapy exam setting baseline levels. The physical activity component requires that certain parameters be met before they can be safely advised to participate in the exercise component. These parameters include the results of the participants' self-monitoring of blood glucose, blood pressure, and heart rate. Assessment of these parameters allows an opportunity for participants to interpret their results and critically think about what could be causing fluctuations in glucose and vital sign trends.

Between the academic semester of Fall 2013 and the Spring semester of 2016 the "Active Steps for Diabetes" DSME program was a 3-month long program for non-pregnant adults with type 2 diabetes. Class size was between 8-10 patients so one-on-one

attention and exercise could be more easily facilitated (G. Pariser, personal communication, April 13, 2018).

Between the academic Fall 2013 and Spring 2016 semesters, the program obtained HbA1c levels from participants for pre- and post-program analysis. The HbA1c lab levels from the program were recorded from each patient prior to, and after their completion of the "Active Steps for Diabetes" program. Participation in the DSME program is completely voluntary and participants are allowed to repeat the class as many times as they wish (G. Pariser, personal communication, April 13, 2018).

Methods

Design and data collection. This study was a retrospective, descriptive pre- and post-test design. After obtaining approval from the Institutional Review Board (IRB), a data spreadsheet was retrieved from the director of the "Active Steps for Diabetes" DSME program with de-identified data about its participants. These data included the age, gender, pre-, and post-program HbA1c levels for the 40 patients that participated in the program between the Fall semester of 2013 and the Spring semester of 2016. This de-identified data had already been entered into a Microsoft Excel spreadsheet.

Inclusion and exclusion criteria. The sample for this evaluation was based on patients who participated in the "Active Steps for Diabetes" DMSE program at a community health center located in an urban setting in a Midwest city between the Fall semester of 2013 and the Spring semester of 2016. Inclusion criteria included non-pregnant adults 18 years of age or older, and individuals with type 2 diabetes. Exclusion criteria for this evaluation included individuals under 18 years of age, pregnant women, non-English speaking individuals, and individuals with type 1 diabetes. A total of 40

patients participated and completed this program between the specified dates which were included in this study.

Data Analysis. Descriptive statistical analysis, including means, standard deviations, and frequency distributions were used to summarize demographic data, and the overall findings of this study sample. A paired sample t-test was used to compare pre- and post-program HbA1c levels in patients with type 2 diabetes after the completion of the 3-month long "Active Steps for Diabetes" DSME program. Paired sample t-tests were also used to analyze if age or gender played a significant role in the change in HbA1c levels in these patients.

Results.

Demographics. There were 40 total participants in the "Active Step for Diabetes" DSME program between the Fall semester of 2013 and the Spring semester of 2016. Of these 40 participants, 29 were female (72.5%), and 11 were male (27.5%). The mean age in the sample was 66.9 years old (SD = 5.1). The youngest participant was 56 years old and the oldest participant was 82.

HbA1c level changes. The average decrease in HbA1c levels was 0.68% (t = 5.6, $p < .001$) over a 3-month period.

Discussion

The anticipated results of the study were to find an effective decrease in the HbA1c levels after completion of the "Active Steps for Diabetes" DSME program. Results of this study showed there was a statistically significant decrease in HbA1c levels among those who participated and completed the program. The findings from this study are comparable to the findings of previously discussed published findings on the effects

of diabetes self-management education programs decreasing the HbA1c levels in patients with type 2 diabetes (Adam et al., 2017; Chai et al., in press; Hill-Briggs et al.,2011; Mash et al., 2012; Rasekaba et al., 2012; Silva et al., 2011; Welch et al., 2011 & Yuan et al., 2014). Data analysis showed no correlation between the effects of age or gender on HbA1c levels pre- and post-program.

The average decrease in HbA1c levels from this study coincides with research from epidemiological studies showing that even a 1% reduction in HbA1c levels can lead to health benefits over a 10-year period (Stratton, Adler, & Neil, 2000; Norris et al., 2002). These data suggest that over the course of 3 months, individuals with type 2 diabetes could benefit from education on their disease and self-management techniques on how to care for themselves and manage their disease. Furthermore, Norris et al (2002) suggests that additional clinical time spent with these patients on diabetes self-management can decrease the HbA1c levels even more (1% for every 23.6 extra hours of additional interaction time).

The area in which the "Active Steps for Diabetes" program excels most prominently is in developing personal strategies to promote health and behavior change. This program offers many of the tools necessary to create behavior change and uses an implementation model similar to the nursing process of assessment, plan, of care, implementation, and evaluation. Standard DSME programs suggest class completion with behavior change implemented into lifestyles on an individual basis. Conversely, the "Active Steps for Diabetes" program is offered 2-3 times each year, and participants are encouraged to return each session to aid in continuance of lifestyle changes and receive support from the peers and mentors involved. Maintenance education has been shown as

a crucial part in behavior change in well-known programs such as Alcoholics Anonymous (Kelly, Stout, Magill, Tonigan, & Pagano, 2010).

Limitations

There were several limitations to this study. One limitation of this study was its small sample size. This could partly be contributed to the design of the study, however smaller class sizes allowed for a more intimate setting for the individualized self-management education to take place. While age and gender were independent variables that did not affect the significance of the results, there was a narrow range of patient ages throughout the study. Data on patient ethnicity was not available. Lastly, as this was a retrospective pre- and post-program study, there was not a maintenance or control group for which the study participants could be compared. Study participants were compared to themselves pre- and post-program completion.

Implications for Research and Practice Recommendations

The findings of this study support the implementation of diabetes self-management education programs into clinical practice. As this study suggests, there are specific diabetes clinical measures, such as HbA1c, that be improved through the self-management education and techniques. More research much be performed in order to identify in which patient populations and settings these programs would succeed, however each research study has shown DSME to be a success in helping patients decrease their HbA1c level. Advance practice nurses have the education and resources to spearhead programs like these into their practice.

The evidence from this study, as well as from past studies reflects the ability of a DSME program to decrease the HbA1c level in patients with type 2 diabetes. By

decreasing HbA1c levels, the risk for diabetes related comorbidities is greatly reduced. The cost savings associated with the reductions in HbA1c and diabetes comorbidities is exponential therefore leading to a significant decrease in the economic burden of type 2 diabetes in the U.S. Continued research into the implementation of these programs needs to be performed in order to improve their effects on different patient populations and settings. Variables such as ethnicity and socioeconomic status should be evaluated for their effects on these program results and data. Also, the ability to bring this type of education and information to patients who cannot attend class can be explored using telehealth and telemedicine. The evidence supports guideline recommendations for comprehensive diabetes self-management education programs and should encourage providers to implement similar programs into their plan of care for patient with type 2 diabetes.

Conclusion

With the startling statistics on the prevalence of type 2 diabetes in the United States, it is imperative for primary care providers to deliver the most up-to-date and evidence-based research in the education, care, and management of diabetes to their patients. The "Active Steps for Diabetes" DSME program is one example of a guideline-based program to aid patients in the maintenance of their own disease. This program includes the resources and education to help individuals make healthier lifestyle choices including a diet plans, exercise plan, and a medication and treatment regimen. This type of program is built on a foundation of evidence and has shown to be effective in several research studies.

As type 2 diabetes is a largely preventable disease, it is the responsibility of primary care providers to lead the way with evidence-based research and implementation of this evidence into practice. Advanced practice nurses are at the forefront of the healthcare field and have the perfect opportunity to change the face of healthcare and improve the health outcomes for their patients. The application of diabetes self-management education programs like the "Active Steps for Diabetes" program has proven to be an invaluable resource for patients with type 2 diabetes and should be supported and encouraged by primary care providers all across the United States.

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Practice Inquiry Project Conclusion

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Conclusion

Type 2 diabetes is continuing to climb as a catastrophic health epidemic in the United States. The health consequences, as well as the healthcare costs related to this problem are becoming overwhelming to the entire healthcare system. It is the responsibility of providers to educate patients on the importance of accountability in their own disease management, as well as aiding in the distribution of resources to guide their health maintenance.

Healthy People 2020 has outlined important, and achievable goals to help providers and patients alike in the struggle to improve their health outcomes. A treatment plan consisting of a diabetes self-management education program can help lead to an even greater success. These program goals and outcomes are reinforced by diabetes guidelines, only some of which were discussed in this project. The guidelines call for a comprehensive and individualized treatment plan for patients with type 2 diabetes, and programs such as the "Active Steps for Diabetes" program is a leading example of this idea.

While primary care providers cannot fix the problem of type 2 diabetes, they play a significant and integrative role in the process. Their knowledge and expertise, in collaboration with a multi-disciplinary healthcare team, help to identify the problem with diabetes management. They can help connect patients with the resources and programs available to them as they work towards improving their disease management and overall health outcomes.